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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/650,610	08/27/2003	Kentaro Nagoshi	TOW-038	8319

959 7590 05/02/2005

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EXAMINER	
AUSTIN, MELISSA J	
ART UNIT	**PAPER NUMBER**
1745	

DATE MAILED: 05/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/650,610	NAGOSHI ET AL.	
	Examiner	Art Unit	
	Melissa Austin	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 February 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 4-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 4-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1, and 4-15 are pending in this application after the amendment submitted 24 February 2005. Claims 1, 4, and 10 are amended. Claims 2 and 3 are cancelled.

Information Disclosure Statement

2. The Information Disclosure Statement (IDS) filed on 24 February 2005 has been considered by the examiner.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214), and further in view of Watkins et al. (5,108,849).

With respect to claim 1, Fly teaches a fuel cell with a membrane electrode assembly (MEA) including anode and cathode catalyst layers sandwiching a solid polymer electrolyte membrane (Figure 4: 68, 70, and 64; Pg. 3, [0044]). A bipolar plate assembly includes a metallic foam media (applicant's foamed member made of metal) gas distribution layer (applicant's diffusion member) and a separator plate and is disposed on either side of the MEA with the gas distribution layers adjacent the MEA (Pg. 1, [0004], [0008]; Pg. 3, [0045]). The gas distribution layer is a sheet of porous media with regions of varying porosity. Fly also teaches that the gas distribution layer includes alternating strips of high porosity material and low porosity material (Figure 7: 46.4, 46.6). The low porosity strips form barriers (applicant's flow field walls) to channel the flow of reactant gases across the face of the MEA (Pg. 4, [0055]; applicant's reactant gas flow through flow field along electrode). However, Fly fails to teach a resinous member in the metallic foam gas distribution layer.

Reiser teaches a fuel cell with a porous gas diffusion layer (applicant's diffusion member) that is impregnated with resin (Pg. 4, [0033], [0034]) for the purpose of forming an electrolyte dry-out barrier. The dry-out barrier allows for the fuel cell to receive very dry reducing fluid and oxidant streams without drying out the electrolyte (Pg. 5, [0039]). Impregnate means "to fill throughout; saturate;" thus, one of ordinary skill in the art would realize that impregnating a porous substrate, fills the pores and creates a region of lower porosity than that of the bulk material.

Neither Fly nor Reiser disclose flow field walls extending from opposite ends of an electrode alternately forming a serpentine passage.

However, Watkins teaches a single continuous fluid flow channel (applicant's reactant gas flow field) in a serpentine pattern. As seen in Figure 2, the flow field walls alternately extend from opposite ends of the electrode. This configuration traverses the electrode in a plurality of closely spaced passes assuring access to the reactant gases to substantially the entire electrode surface. The continuous channel also ensures that water formed is pushed through the channel by the gas flow and exhausted from the cell so that no dead spots form due to blockages. (Col. 5, ll. 52-57, 66- Col 6, ll. 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated with resin, as taught by Reiser, sections of the metallic foam gas distribution layer of the fuel cell taught by Fly et al. in order to create serpentine channels as taught by Watkins for the purpose of forming an electrolyte dry-out barrier allowing for delivery of very dry reducing fluid and oxidant streams to the fuel cell without drying out the electrolyte and to channel reactant gases across the face of the MEA in such a way to prevent water blockages and effectively cover the electrode surface with reactant gas.

Regarding claim 4, the limitations of claim 1 discussed immediately above are incorporated herein. Fly does not teach the method by which the areas of lower porosity are created in the metallic foam gas distribution layer; however, Reiser teaches impregnation of the porous gas diffusion layer with resin. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed the flow field walls in the gas distribution layer as taught by Fly et al. by

impregnating with resin the porous gas diffusion layer as taught by Reiser in order to deliver very dry reducing fluid and oxidant to the electrode without drying out the electrolyte.

5. Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214), and further in view of Rock (6,099,984).

With respect to claim 1, Fly teaches a fuel cell with a membrane electrode assembly (MEA) including anode and cathode catalyst layers sandwiching a solid polymer electrolyte membrane (Figure 4: 68, 70, and 64; Pg. 3, [0044]). A bipolar plate assembly includes a metallic foam media (applicant's foamed member made of metal) gas distribution layer (applicant's diffusion member) and a separator plate and is disposed on either side of the MEA with the gas distribution layers adjacent the MEA (Pg. 1, [0004], [0008]; Pg. 3, [0045]). The gas distribution layer is a sheet of porous media with regions of varying porosity. Fly also teaches that the gas distribution layer includes alternating strips of high porosity material and low porosity material (Figure 7: 46.4, 46.6). The low porosity strips form barriers (applicant's flow field walls) to channel the flow of reactant gases across the face of the MEA (Pg. 4, [0055]; applicant's reactant gas flow through flow field along electrode). However, Fly fails to teach a resinous member in the metallic foam gas distribution layer.

Reiser teaches a fuel cell with a porous gas diffusion layer (applicant's diffusion member) that is impregnated with resin (Pg. 4, [0033], [0034]) for the purpose of forming an electrolyte dry-out barrier. The dry-out barrier allows for the fuel cell to receive very dry reducing fluid and oxidant streams without drying out the electrolyte (Pg. 5, [0039]). Impregnate means "to fill throughout; saturate;" thus, one of ordinary skill in the art would realize that impregnating a porous substrate, fills the pores and creates a region of lower porosity than that of the bulk material.

Neither Fly nor Reiser disclose flow field walls extending from opposite ends of an electrode alternately forming a serpentine passage.

However, Rock teaches that serpentine flow channels (applicant's reactant gas flow field) are known and provide the advantage that they permit gas flow between adjacent legs of the same channel even then the flow channel is blocked (Col. 2, ll. 3-22). Rock also teaches a serpentine pattern in which

the legs extend from opposite ends of the electrode; that is the inlet legs extend from one end and the outlet legs extend from the other end (Col. 5, ll. 19-29; Figure 5). This configuration places inlet legs adjacent other inlet legs and outlet legs adjacent other outlet legs; therefore, no pressure drop is developed between inlet legs resulting in no leakage under normal operating conditions from one leg to another (Col. 5, ll. 46-51).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have employed serpentine channels as taught by Rock in the fuel cell as taught by Fly and Reiser in order to prevent blockages and reduce the occurrence of leakage from one leg to another under normal operating conditions.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated with resin, as taught by Reiser, sections of the metallic foam gas distribution layer of the fuel cell taught by Fly et al. in order to create serpentine channels as taught by Rock for the purpose of forming an electrolyte dry-out barrier allowing for delivery of very dry reducing fluid and oxidant streams to the fuel cell without drying out the electrolyte and to channel reactant gases across the face of the MEA in such a way to prevent blockages and reduce the occurrence of leakage from one leg to another under normal operating conditions.

Regarding claim 4, the limitations of claim 1 discussed immediately above are incorporated herein. Fly does not teach the method by which the areas of lower porosity are created in the metallic foam gas distribution layer; however, Reiser teaches impregnation of the porous gas diffusion layer with resin. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed the flow field walls in the gas distribution layer as taught by Fly et al. by impregnating with resin the porous gas diffusion layer as taught by Reiser in order to deliver very dry reducing fluid and oxidant to the electrode without drying out the electrolyte.

6. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) and further in view of Watkins et al. (5,108,849) as

applied to claim 1 above, and further in view of Kuroki et al. (WO 2002/089240, using US 2004/0137303 as translation). The limitations of claim 1 discussed immediately above are incorporated herein.

Regarding claims 5 and 6, none of Fly, Reiser, or Watkins disclose resinous flow field walls forming a reactant gas passage for flowing reactant gas in the stacking direction of the fuel cell.

However, Kuroki teaches a gas diffusion layer (applicant's diffusion member) with a gasket material impregnation portion (Figure 15: 5, 10). The impregnation material can be resin (Pg. 5, [0068]). As seen in Figure 19, a section of the impregnated gas diffusion layer can be cut out to provide a manifold (Pg. 9, [0122]; applicant's reactant gas passage) with resinous walls. A stack is assembled by placing separators on either side of the unit electrode assembly (UEA); as such, this manifold allows for flow of the reactant gasses in the stacking direction of the cell. This structure provides for easier stacking of the separator and UEA, automation of the process, and reduction in the cost for manufacturing the stack.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included in the fuel cell as taught by Fly, Reiser, and Watkins the manifold for reactant gas passage in the stacking direction of the fuel cell with resinous walls formed by impregnation as taught by Kuroki in order to provide for easier stacking of the separator and UEA, automation of the process, and reduction in the cost for manufacturing the stack.

Regarding claims 7 and 8, none of Fly, Reiser, or Watkins disclose a resinous seal forming a reactant gas passage for flowing reactant gas in the stacking direction of the fuel cell.

However, Kuroki teaches a gas diffusion layer (applicant's diffusion member) with a gasket material impregnation portion (Figure 15: 5, 10). The impregnation material can be resin (Pg. 5, [0068]). As can be seen in Figure 19, an insulating spacer (12, 13) can be formed by impregnating the gas diffusion layer (5, 6) with resin (Pg. 5, [0074]). Although the reference does not disclose this structure as a seal, one of ordinary skill in the art would recognize that it acts as a seal between the unit electrode assembly (UEA; 2,3,4) and manifold. As is well known in the art, without seals, reactant gasses could mix or escape from the cell structure.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included the insulating spacers as taught by Kuroki in the fuel cell as taught by Fly, Reiser, and Watkins in order to prevent reactant gasses from mixing or escaping the cell structure.

7. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) and further in view of Rock (6,099,984) as applied to claim 1 above, and further in view of Kuroki et al. (WO 2002/089240, using US 2004/0137303 as translation). The limitations of claim 1 discussed immediately above are incorporated herein.

Regarding claims 5 and 6, none of Fly, Reiser, or Rock disclose resinous flow field walls forming a reactant gas passage for flowing reactant gas in the stacking direction of the fuel cell.

However, Kuroki teaches a gas diffusion layer (applicant's diffusion member) with a gasket material impregnation portion (Figure 15: 5, 10). The impregnation material can be resin (Pg. 5, [0068]). As seen in Figure 19, a section of the impregnated gas diffusion layer can be cut out to provide a manifold (Pg. 9, [0122]; applicant's reactant gas passage) with resinous walls. A stack is assembled by placing separators on either side of the unit electrode assembly (UEA); as such, this manifold allows for flow of the reactant gasses in the stacking direction of the cell. This structure provides for easier stacking of the separator and UEA, automation of the process, and reduction in the cost for manufacturing the stack.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included in the fuel cell as taught by Fly, Reiser, and Rock the manifold for reactant gas passage in the stacking direction of the fuel cell with resinous walls formed by impregnation as taught by Kuroki in order to provide for easier stacking of the separator and UEA, automation of the process, and reduction in the cost for manufacturing the stack.

Regarding claims 7 and 8, none of Fly, Reiser, or Rock disclose a resinous seal forming a reactant gas passage for flowing reactant gas in the stacking direction of the fuel cell.

However, Kuroki teaches a gas diffusion layer (applicant's diffusion member) with a gasket material impregnation portion (Figure 15: 5, 10). The impregnation material can be resin (Pg. 5, [0068]). As can be seen in Figure 19, an insulating spacer (12, 13) can be formed by impregnating the gas diffusion layer (5, 6) with resin (Pg. 5, [0074]). Although the reference does not disclose this structure as a seal, one of ordinary skill in the art would recognize that it acts as a seal between the unit electrode assembly (UEA; 2,3,4) and manifold. As is well known in the art, without seals, reactant gasses could mix or escape from the cell structure.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included the insulating spacers as taught by Kuroki in the fuel cell as taught by Fly, Reiser, and Rock in order to prevent reactant gasses from mixing or escaping the cell structure.

8. Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) and further in view of Watkins et al. (5,108,849). The limitations of claim 1 discussed above are incorporated herein.

The references do not specifically disclose resinous supports in the diffusion member.

Regarding claim 9 and 13, however, the areas of lower porosity as taught by Fly formed by impregnation of resin into the gas diffusion layer as taught by Reiser would inherently possess the ability to support a load applied to the fuel cell in the stacking direction absent any clear evidence to the contrary. Applicant has imposed no definite structure to the supports.

Regarding claim 10, the limitations of claim 9 as discussed immediately above are incorporated herein. Fly's areas of low porosity (Figure 6: 46.6) extend to the surface of the gas distribution layer. One of ordinary skill in the art would recognize that when assembled next to the electrode catalyst layer, these low porosity areas are spaced a predetermined distance from the catalyst layer.

Regarding claims 11 and 12, one of ordinary skill in the art would recognize that when stacked the resinous supports would provide the greatest support of a load in the stacking direction if they are aligned in the stacking direction, thus creating a continuous reinforcement.

9. Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) and further in view of Rock (6,099,984). The limitations of claim 1 discussed above are incorporated herein.

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Regarding claim 10, the limitations of claim 9 as discussed immediately above are incorporated herein. Fly's areas of low porosity (Figure 6: 46.6) extend to the surface of the gas distribution layer. One of ordinary skill in the art would recognize that when assembled next to the electrode catalyst layer, these low porosity areas are spaced a predetermined distance from the catalyst layer.

Regarding claims 11 and 12, one of ordinary skill in the art would recognize that when stacked the resinous supports would provide the greatest support of a load in the stacking direction if they are aligned in the stacking direction, thus creating a continuous reinforcement.

Allowable Subject Matter

10. Claims 14 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. The following is a statement of reasons for the indication of allowable subject matter: the prior art does not state: 1) a metal stopper interposed between resinous supports or 2) resinous supports are planar plates embedded in foamed member.

Response to Arguments

12. Applicant's arguments with respect to claim 1 have been considered but are moot in view of applicant's amendment.

13. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melissa Austin whose telephone number is (571) 272-1247. The examiner can normally be reached on Monday - Thursday, alt. Friday, 7:15 AM - 4:15 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

mja

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